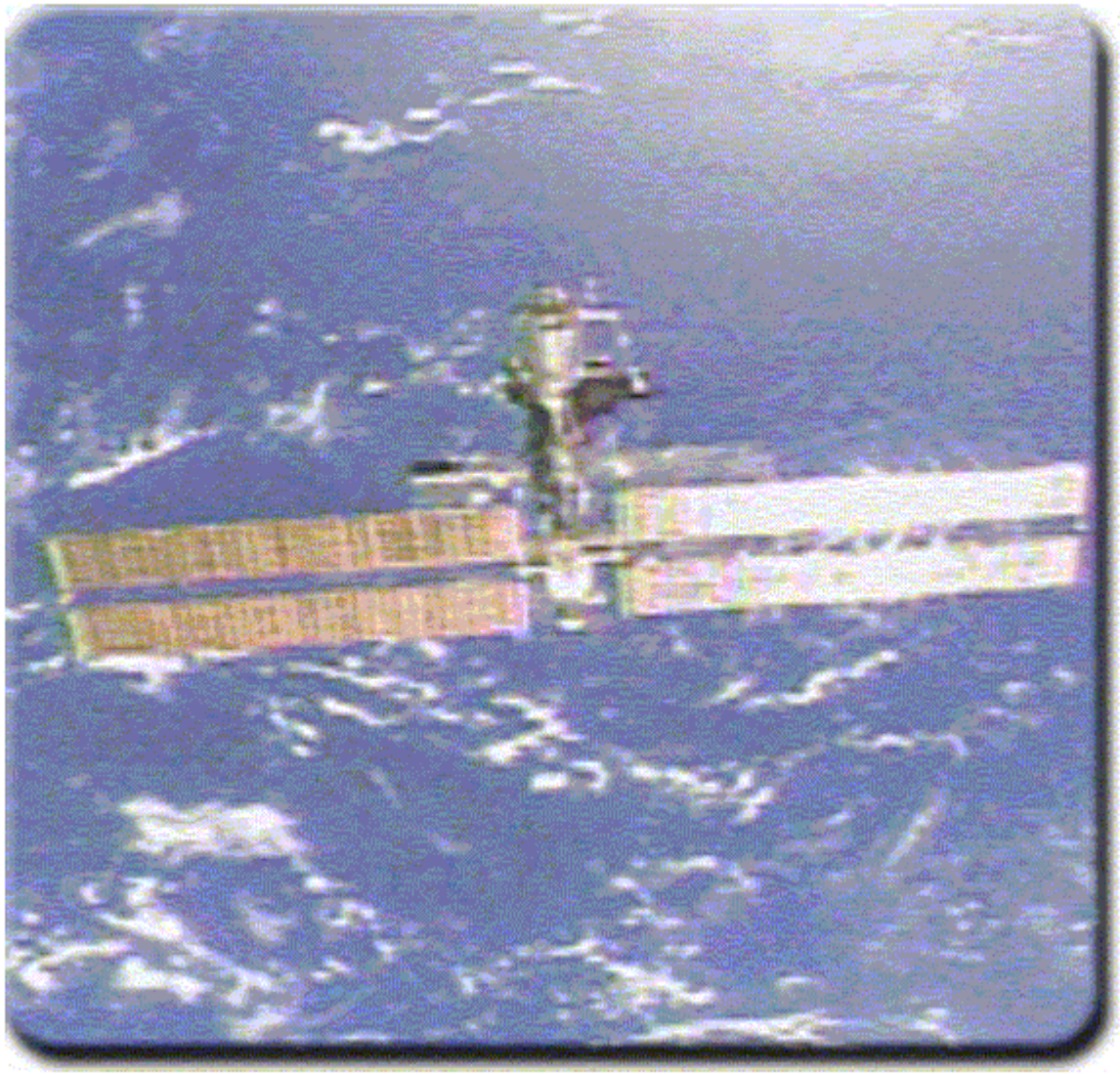
UF-2 Utilization Overview



UF-2 Utilization Overview Outline

- Introduction/Mission Overview
- Payloads
  - Microgravity Science Glovebox (MSG)
    - Glovebox Integrated Microgravity Isolation Technology (g-LIMIT)
    - Pore Formation and Mobility Investigation (PFMI)
    - Solidification Using a Baffle in Sealed Ampoules (SUBSA)
    - Investigating the Structure of Paramagnetic Aggregates from Colloidal Emulsions (InSpace)
  - EXPRESS Rack 3
    - Dynamically Controlled Protein Crystal Growth(DCPDG)
    - Protein Crystal Growth-Single Locker Thermal Enclosure System(PCG-STES)
    - Advanced Astroculture (ADVASC)
  - Payload Interfaces
  - Fluids
  - Stowage
- PTCS/User Room Configuration
- Schedule/Test Flow Diagram
- Lessons Learned
- Key Contacts/Web Sites

Microgravity Science Glovebox

- Developed under ESA International Agreement for delivery as early contribution item
- International Standard Payload Rack (ISPR) facility scheduled for launch on UF-2 integrated in the Multi-Purpose Logistics Module (MPLM)

MSG (continued)

- Currently scheduled to fly in US Lab, later transferred to COFF
- 10+ year operational life
- Four MSG units
  - Ground Unit @MSFC
  - Training Unit @JSC
  - Engineering Unit @MSFC
  - Flight Unit (on orbit Inc 5/UF2)

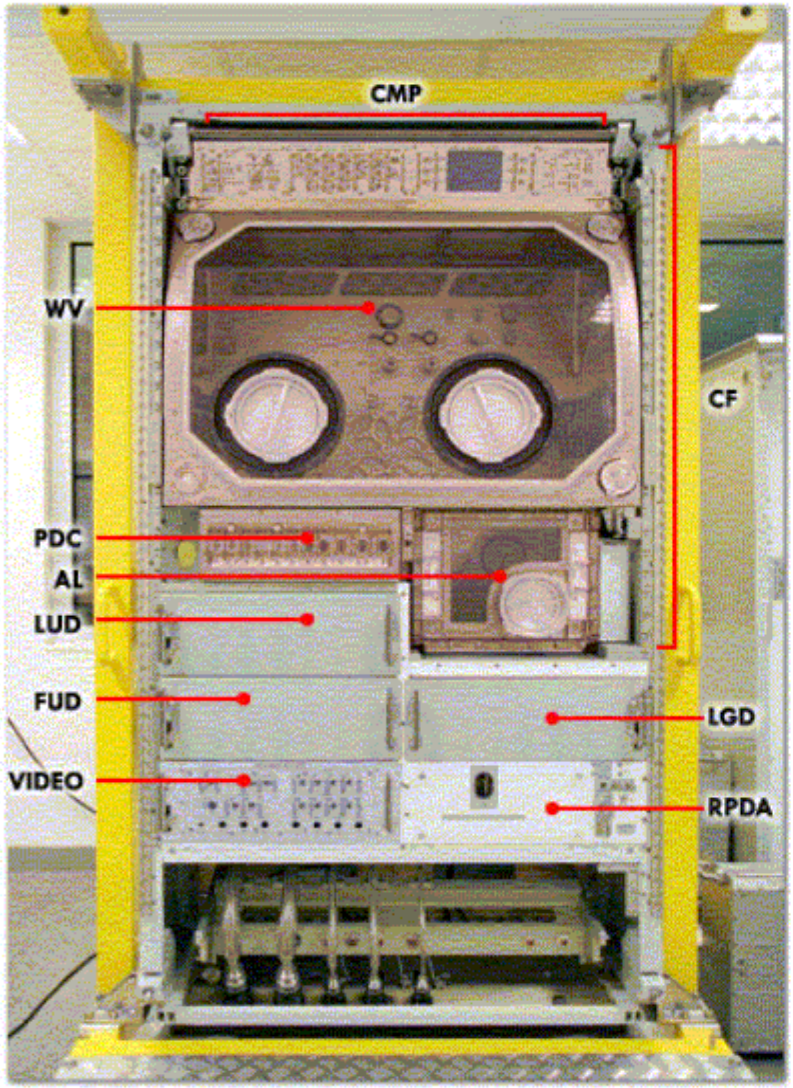
MSG Objective:

- The facility provides a .26 cubic meter sealed environment well suited for conducting small science and technology experiments.
- Continuous air circulation produces a negative pressure in the MSG, which combines with the sealed environment to provide a double level of containment.
- MSG is particularly suited for handling hazardous materials in a manned environment.
- MSG is designed to operate with various investigations, usually one at a time.

Investigation Types

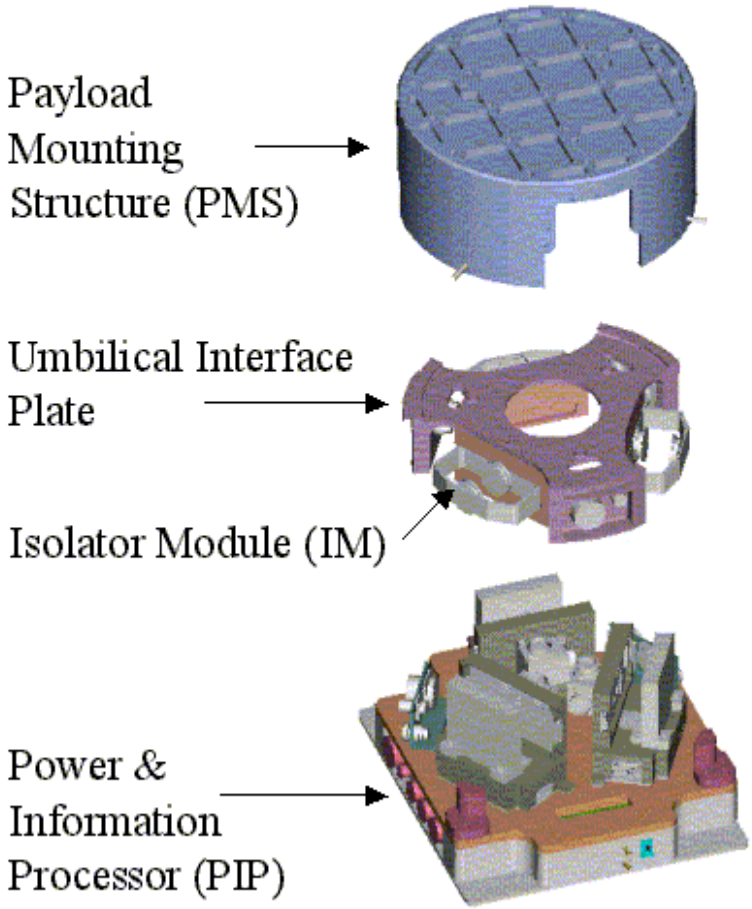
- Fluid Physics
- Combustion Science
- Materials Science
- Biotechnology
- Space Processing
- Technology Demonstrations
- NOT intended for use with Life Sciences

Hardware Overview



- Control & Monitoring Panel (CMP)
- Work Volume (WV)
- Core Facility (CF) – extendable/retractable portion of unit
- Power Distribution & Control Box (PDC)
- Airlock (AL)
- Remote Power Distribution Assembly (RPDA)
- 4 stowage drawers:
- Low Use Drawer (LUD)
- Frequent Use Drawer (FUD)
- Logistics Drawer (LGD)
- Video Drawer

GLovebox Integrated Microgravity Isolation Technology (g-LIMIT)



SCIENCE OBJECTIVE

g-LIMIT is a vibration isolation system designed to provide a quiescent acceleration environment and optimized for use in the Microgravity Science Glovebox (MSG).

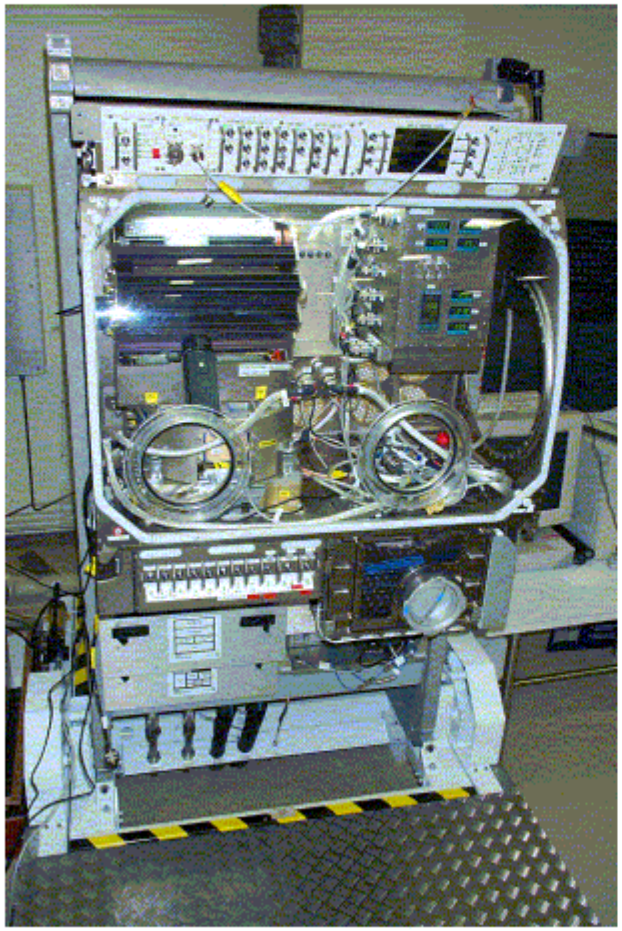
Glovebox Integrated Microgravity Isolation Technology (g-LIMIT)

HARDWARE DESCRIPTION

g-LIMIT interfaces between an experiment and the MSG in such a way that MSG and experiment-induced disturbances are attenuated. Major components of the system include:

- **Payload Mounting Structure** - structural mounting plate which provides common MSG structural and resource interfaces.
- **Isolator Module (3)** -Self contained integrated modules which consist of a two-axis actuator, a two axis accelerometer, and two-axis position sensor and the electronics
- **PIP Power and Information Processor** - The PIP does supervisory functions, power conversion/conditioning, UBS actuator drivers, data acquisition and data handling.
- **Dynamics Characterization Payload (DCP)** produces calibrated disturbances used for characterization of g-LIMIT performance and robustness.
- **Three Axis Reference Accelerometer (TRIAX)** sensors used to measure base (non-isolated) acceleration for reference.

Pore Formation and Mobility Investigation (PFMI)

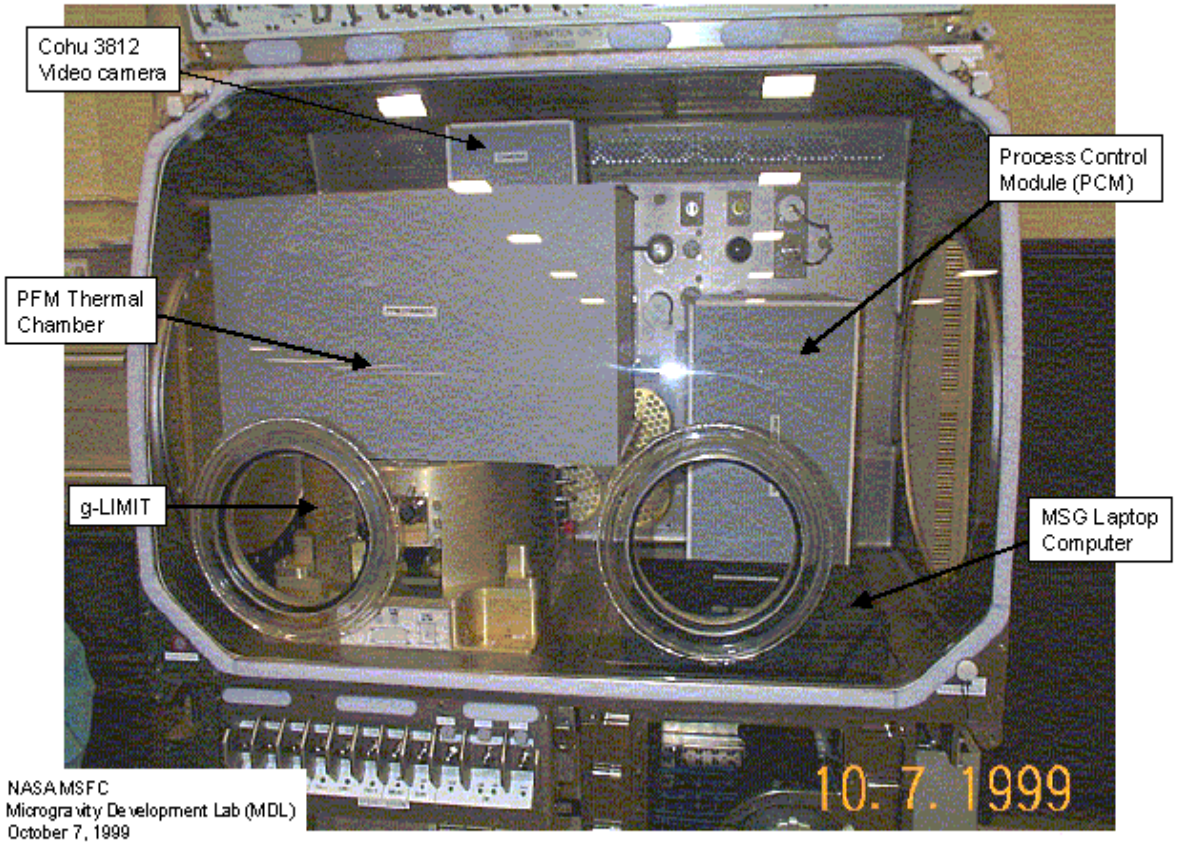


SCIENCE OBJECTIVE

- PFMI is a materials science investigation in which succinonitrile crystals will be grown in a processing chamber in the Microgravity Science Glovebox (MSG). The science objectives of this investigation are to improve the production of uniform composites and to promote the understanding of detrimental porosity formation and mobility during controlled directional solidification processing in a microgravity environment

PFMI Hardware Overview

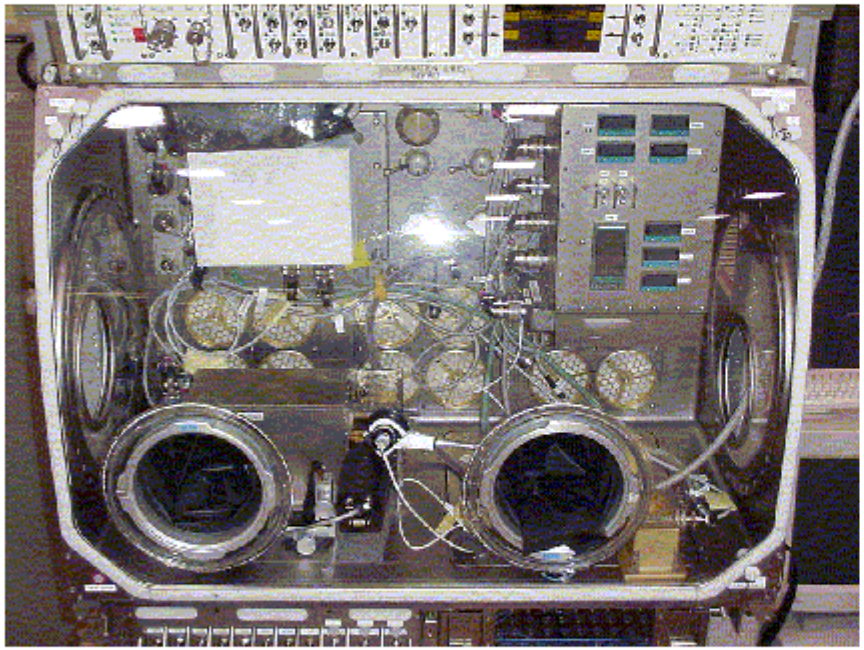
FRONT VIEW: PFM/g-LIMIT Layout in the MSG Work Volume



NASA MSFC
Microgravity Development Lab (MDL)
October 7, 1999

- Thermal Chamber-Processing time~7 hours per sample
- Process Control Module(PCM)
- Data Acquisition Pad(DaqPa
- Sample Ampoules -12 + 3 spares
- Video Cameras (2)
- PFMI will also use g-LIMIT for vibration isolation inside the MSG

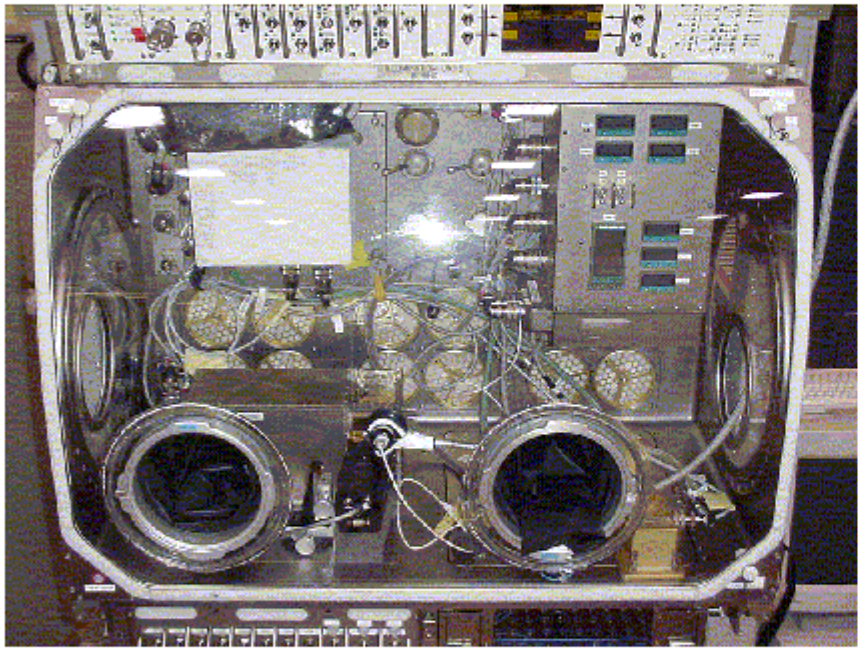
Solidification Using a Baffle in Sealed Ampoules (SUBSA)



SCIENCE OBJECTIVE

SUBSA is a materials science investigation in which indium antimonide crystals will be grown in a processing chamber in the Microgravity Science Glovebox (MSG). The science objectives of this investigation are to test an automatically moving baffle to see if it can further reduce gravitationally-induced convective effects in the sample. The behavior and possible advantages of liquid encapsulation in microgravity conditions will also be investigated.

SUBSA HW Overview



HARDWARE DESCRIPTION

Major components of the SUBSA:

Thermal Chamber - Processing time ~ 11 hours per sample

Process Control Module (PCM)

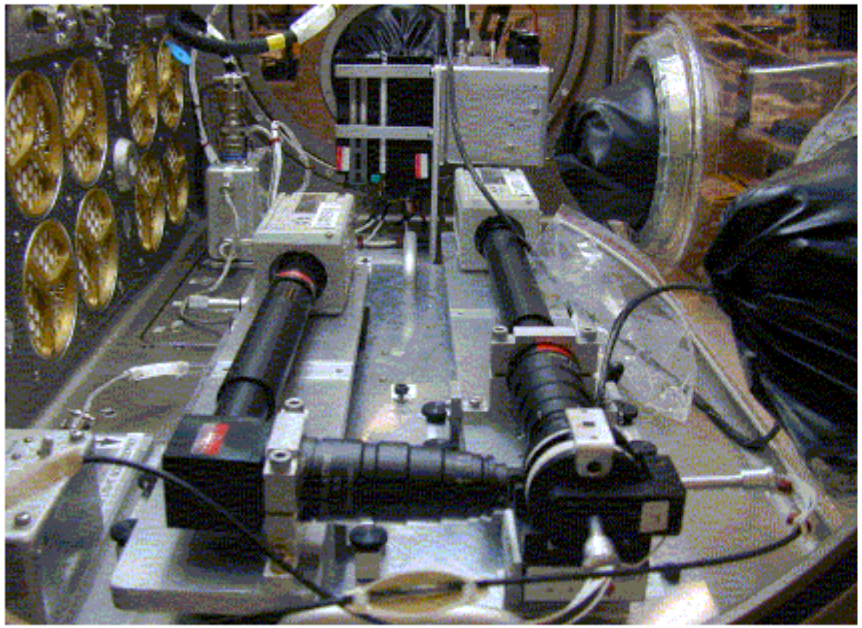
Data Acquisition Pad (DaqPad)

Sample Ampoules - 10 + 2 spares

Video Camera

SUBSA will also use SAMS as a microgravity measurement device.

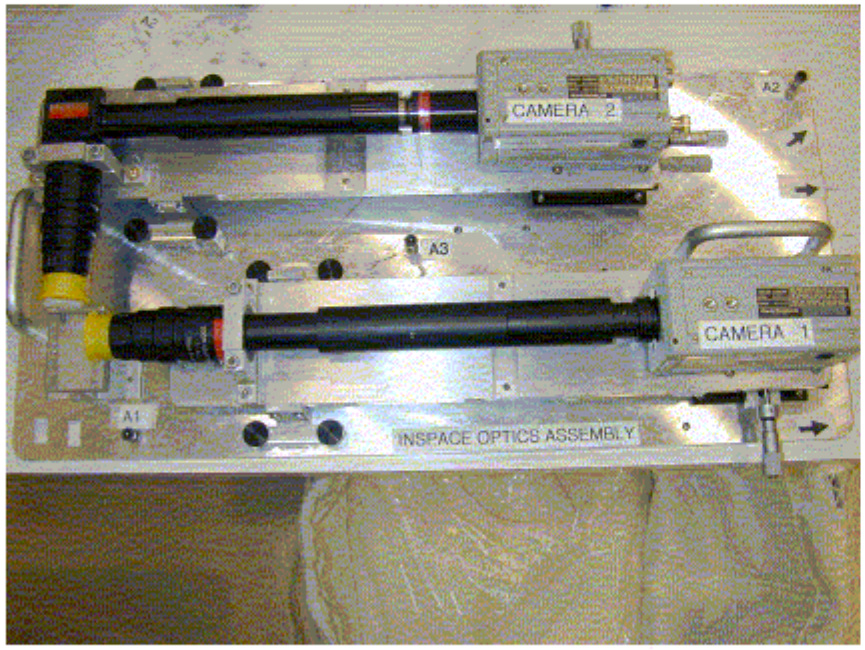
Investigating the Structure of Paramagnetic Aggregates from Colloidal Emulsions (INSPACE)



SCIENCE OBJECTIVE

InSpace will determine the lowest energy configuration of three dimensional structures of a magnetorheological fluid (MR) in a pulsed magnetic field. Visual observations of microscopic structures will yield a better understanding of the interplay between magnetic, interfacial and gravitational forces in MR suspension structures.

InSpace HW Overview



- The **InSpace** investigation consists of the following HW:

The Optics Assembly contains:

1. Helmholtz Coil Assembly
2. Two Hitachi HV-C20 CCD cameras
3. Two x-y translation stages for alignment
4. Two x-y translation slides that allows for movement of the cameras as alignment is performed

InSpace Hardware Overview(cont)

The Avionics Assembly consists of five components:

1. A square wave generator (SWG)
2. A current digital display
3. A frequency digital display
4. A power distribution box
5. The light source box provides adequate back lighting to the samples during runs

Expedite the Processing of Experiments to Space Station(EXPRESS) Rack 3

•EXPRESS Rack 3(ER3) is a standard International Standard Payload Rack (ISPR)

•ER3 is one of two rack equipped with ARIS (Active Rack Isolation System)

•This system uses accelerometers to measure microgravity disturbances, which then activates a system of 8 pushrods to compensate for the disturbance

•The EXPRESS Rack has 8 locker locations and 2 drawers

•This allows it to take several small payloads or larger payloads that are integrated into more than one locker

•Some payloads may even take up all of the EXPRESS Rack

EXPRESS Rack Overview (cont):

The 8/2 EXPRESS rack provides standard interfaces to mid-deck locker compatible payloads or small payloads encapsulated in a drawer

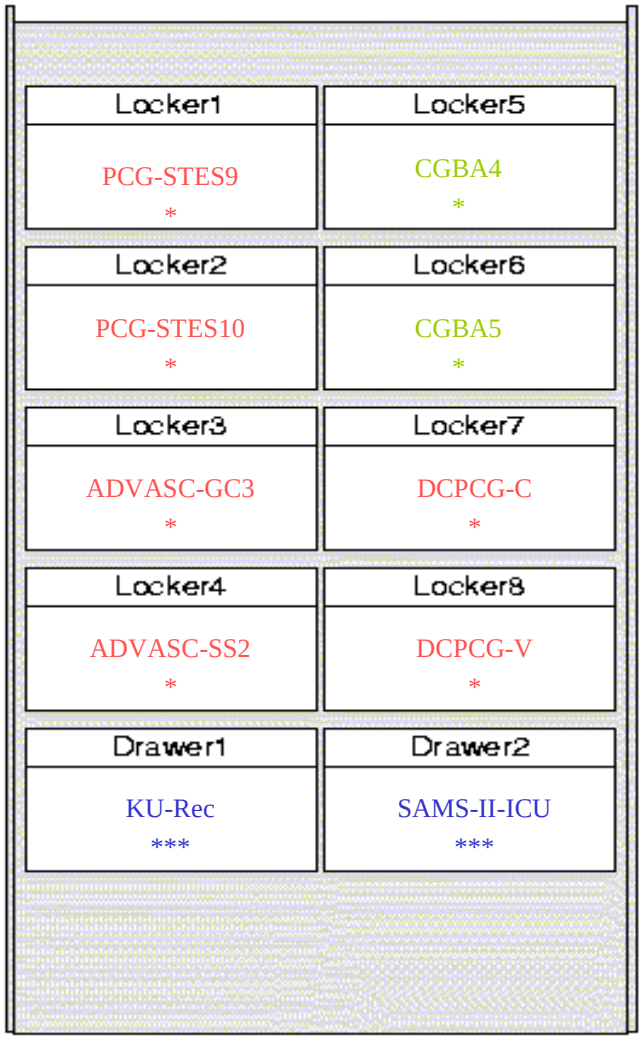
EXPRESS Rack Overview (cont):

Some primary subsystems for the EXPRESS rack are the:

- AAA – Avonics Air Assembly
- SSPCM – Solid State Power Controller Module
- RIC – Rack Interface Controller
- PEHB – Payload Ethernet Hub Bridge
- EMU – Express Memory Unit
- ELC – Express Laptop Computer

EXPRESS RACK 4

UF-2 Payload Locations on Orbit



*Payload on UF-2

**Payload on 8A(STS-110)

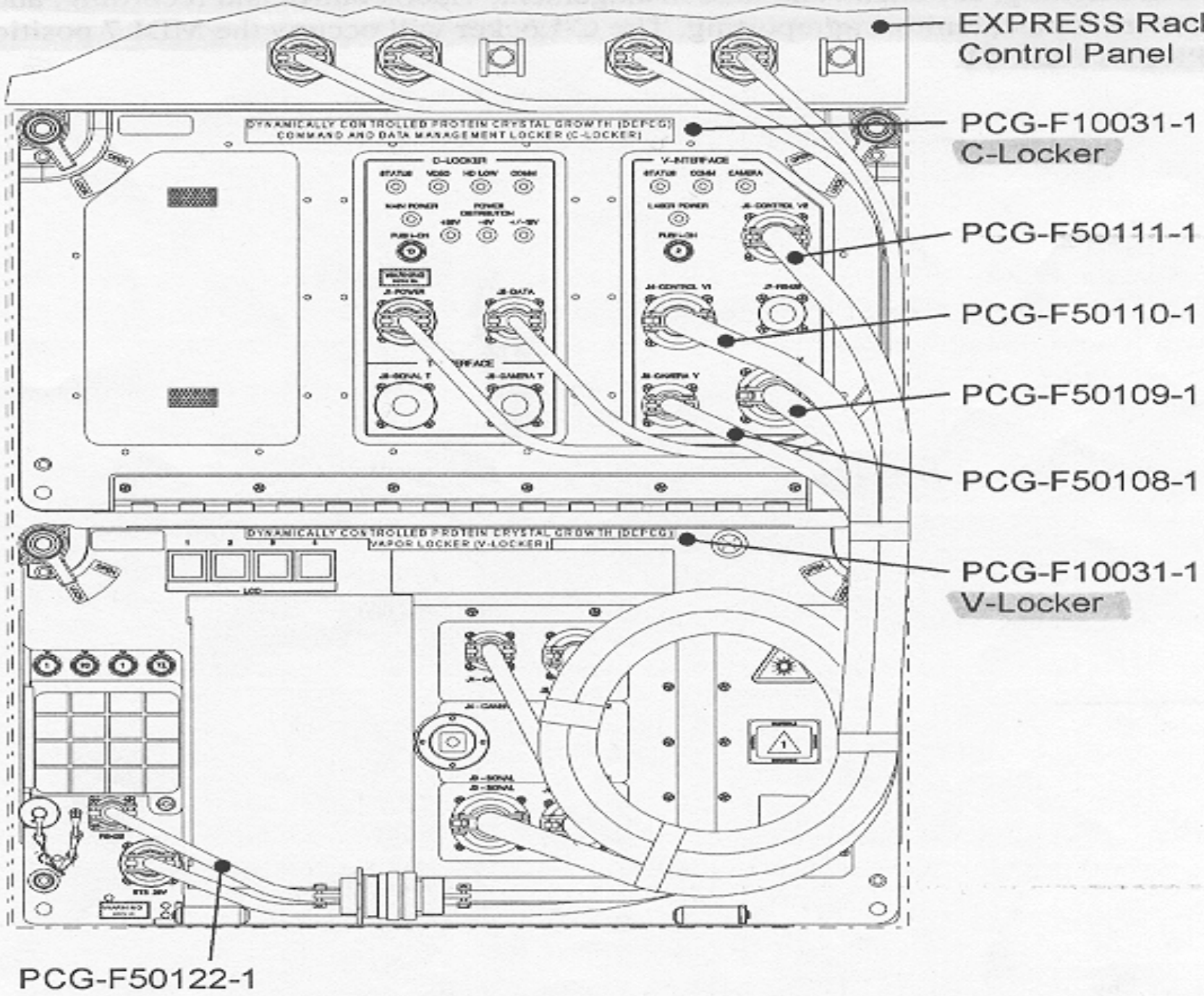
***Currently on Space Station

Dynamically Controlled Protein Crystal Growth (DCPCG)

- DCPCG will be tested at KSC in the FCU configured as EXPRESS Rack 4 in the rack location that matches the on-orbit flight configuration.
  - If it is determined that DCPCG has not changed significantly since the last flight, an OMRS Exception can be taken to forego this test.
- Late Stowage into the MPLM or Shuttle mid-deck is required.
- Biotechnology multi-locker designed by the University of Alabama at Birmingham (UAB)
- Designed to carry out the study of protein crystal growth in micro gravity
  - The primary objective is to manufacture large, high quality, structurally well ordered protein crystals for x-ray analyses leading to development of new drugs
  - A key science objective is to advance protein crystal growth methodology by controlling the super saturation rate via dynamic control of concentration or temperature

DCPCG (cont)

- DCPCG is designed to access the usefulness of dynamic control for improving the success of experiments performed in a micro gravity environment versus those in a 1 g environment
- DCPCG consist of two middeck lockers, each of which is dedicated to a separate function
  - The Command Locker (C-Locker) developed by UAB
    - Contains the commanding electronics, power distribution and conditioning, and video control and recording
  - The Vapor Diffusion Locker (V-Locker)
    - Performs crystal growth through vapor diffusion using dry nitrogen gas to influence the rate of water evaporation from a protein solution


EXPRESS Rack
Control Panel
PCG-F10031-1
C-Locker
PCG-F50111-1
PCG-F50110-1
PCG-F50109-1
PCG-F50108-1
PCG-F10031-1
V-Locker
PCG-F50122-1

PCG-STES

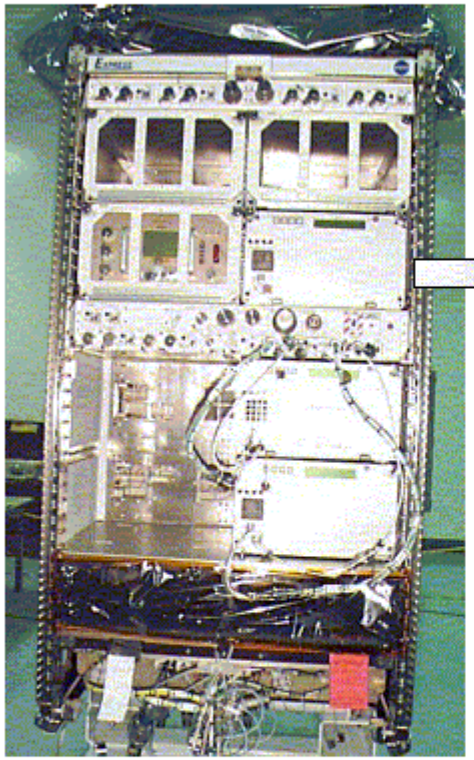
- PCG(Protein Crystal Growth) is developed by MSFC.
- The PCG Experiment consists of the STES (Single Locker Thermal Enclosure System) and the experiments that operate inside it (for example, DCAM, PCAM, and VDA-2). The STES simply provides a temperature controlled environment for various experiments (+4 deg C to +40 deg. C). Actual experiments for UF-2 PCG-STES units 7 & 8 are currently TBD.
- The primary objective of the hardware is to produce high-quality, well-defined crystals of selected proteins in a controlled microgravity environment. The findings will assist biological & physical science research for various applications in medicine, agriculture, & manufacturing.

PCG-STES (cont)

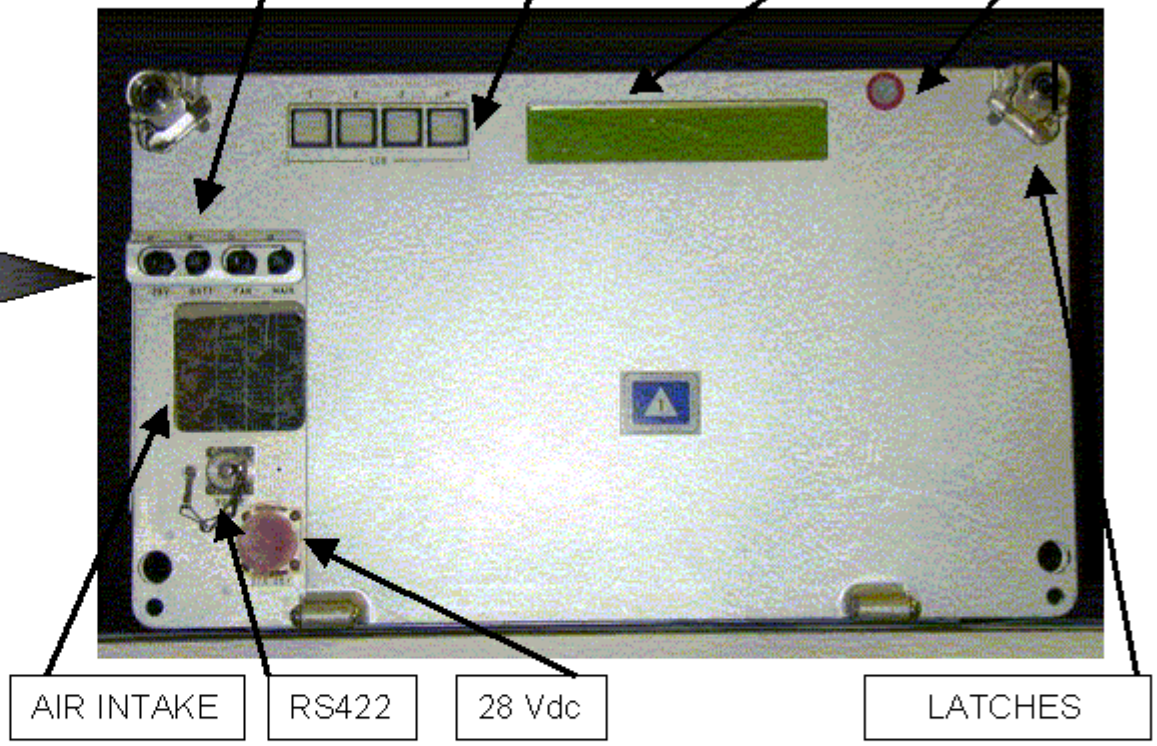
- PCG-STES units will be utilized over and over again on the Space Station.
  - For instance, PCG-STES units 7 & 8 were launched on April 19, 2001 (STS100, 6A), returned via the MPLM for refurbishment on August 10, 2001 (STS105, 7A.1), and scheduled to fly again on April 2002 (STS111, UF-2).
  - PCG-STES units 9 & 10 will be launched for the first time on November 29, 2001 (STS108, UF-1).
- PCG-STES will be tested at KSC in the EXPRESS Rack 3 configured as EXPRESS Rack 4 in the rack location that matches the on-orbit flight configuration.
  - If it is determined that PCG-STES has not changed significantly since the last flight, an OMRS Exception can be taken to forego this test.
  - The EXPRESS Project Office is requiring the support of PCG-STES during the Joint Operations Test with ER3.
  - The UF-2 team may need to take an Exception to this requirement if PCG-STES UF-1 and UF-2 processing conflicts can not be resolved.

PCG-STES

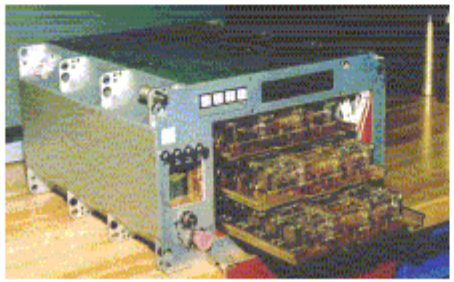
Installed in an
ISS EXPRESS Rack



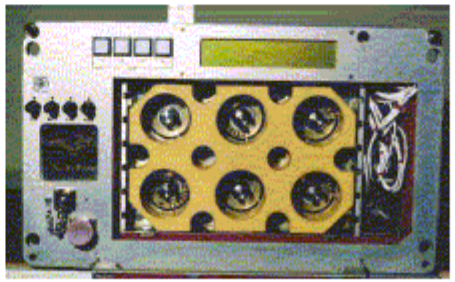
STES



Examples of CG Experiments



Protein Crystallization Apparatus for Microgravity (PCAM)



Diffusion Controlled Apparatus for Microgravity (DCAM)

Vapor Diffusion Apparatus (VDA-2)

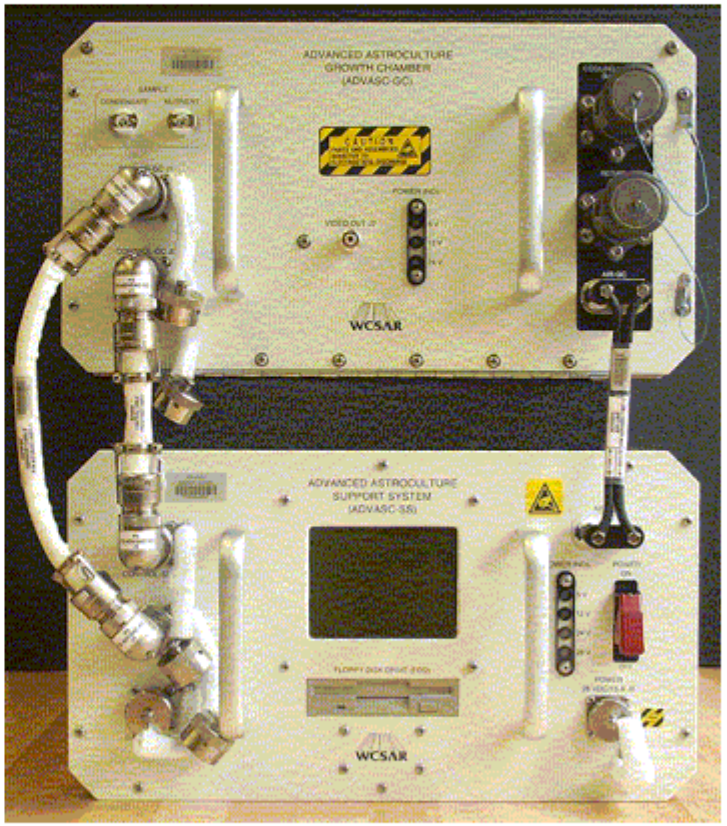
PCG-STES

GROUND PROCESSING CONCERNS

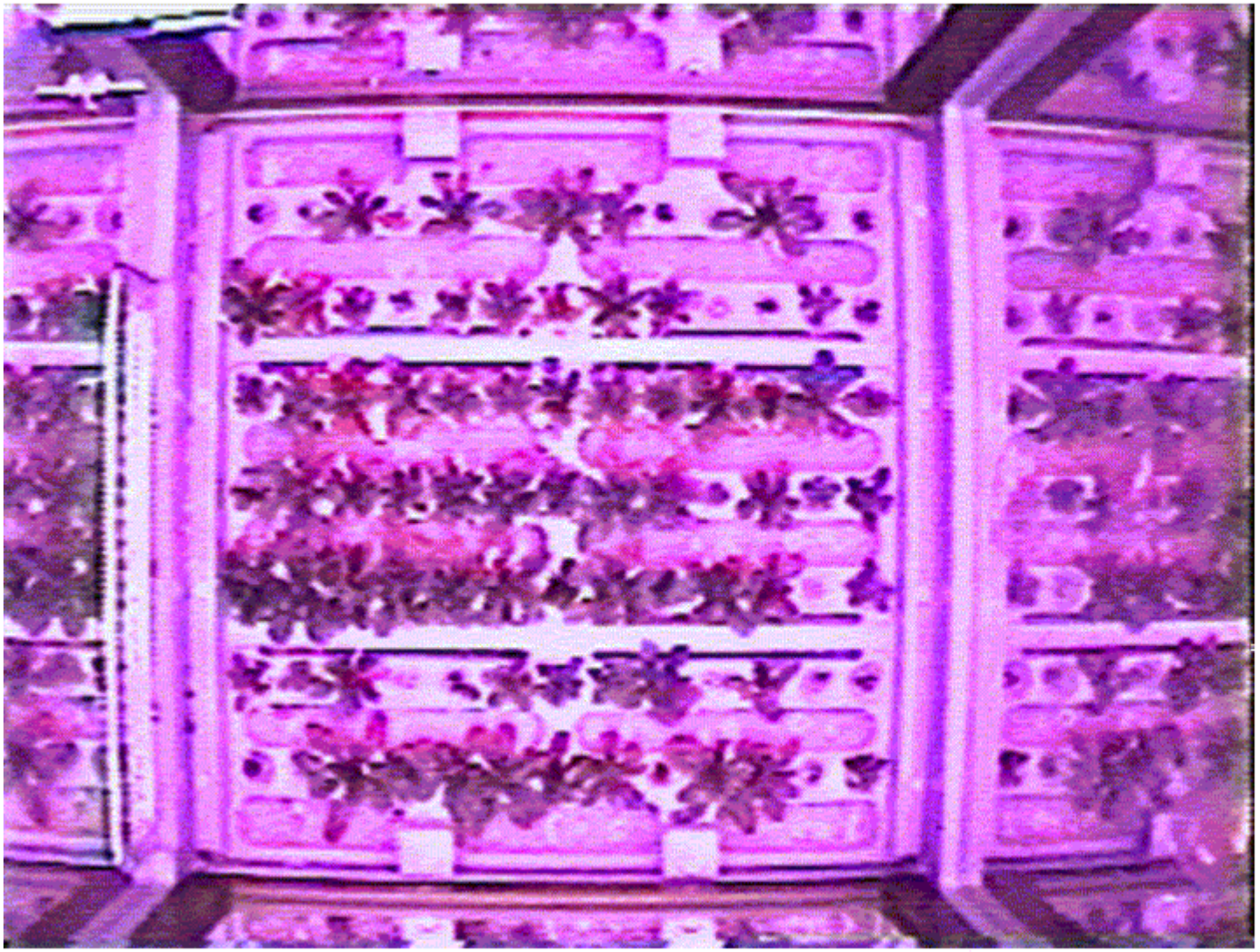
- The PCG-STES is ESD sensitive.
- Wrist straps required for all PCG-STES handling activities
- ESD dissipative gloves (KSC blue gloves) required when handling PCG-STES.
- Pins required to be grounded prior to contacting, mating or de-mating of cables that interface directly to PCG-STES.

Advanced Astroculture (ADVASC)

- ADVASC Components
  - -Growth Chamber (GC) Unit plant growth chambers
  - -Support System (SS) Unit, computers, electronics, cooling, and other systems
- Plant Growth Research using red and blue LED's and a hydroponic type nutrient delivery system.
- ADVASC flew to station on 6A
  - First science returned on 7A
  - Grew *Arabidopsis thaliana* seed to seed in microgravity.
- WCSAR – Wisconson Center for Space Automation and Robotics - Flying hardware since 1992.
- Dr. Weijia Zhou-Principle Investigator, Sam Durst- Mechanical Engineer, Matt Demars-Software Engineer



Arabidopsis in Growth Chamber



ADVANCED ASTROCULTURE (ADVASC)

Near Term Flights

➢ UF-1

- Second Growth Chamber(GC2) to be launched on UF-1
- Original Support System (SS1) remains on orbit from 6A mission
- KSC to test GC2 in Express Rack 3 (ER3), configured as ER4
- GC2 design permits crew access to growth chamber
- UF-1 Science-Arabidopsis Thaliana Plants
- 50% of seeds produced on orbit (6A-7A), 50% produced on Earth

➢ 8A

- ADVASC Hardware returns from ISS (SS1 & GC2)

➢ UF-2

- Second Support System (SS2) and Original Growth Chamber (GC1) to be launched on UF-2
- KSC to test both units in ER3 (configured as ER4)
- SS2 will fly with software upgrades
- UF-2 Science – Soybean Plants

Follow-on Flights

- Commercial Plant Bioproduction Facility (CPBF) will become the largest environmentally controlled plant growth facility on the ISS-Flight 1 J/A

		UF-2 Payload Interfaces and Services used (October 3rd, 2001)								
	MSG	SAMS	SUBSA	PFMI	G-LIMIT	INSPACE	**ER3**	ADVASC	DC-PCG	PCG-STES
Main Power	✓						✓			
Aux Power	✓						✓			
Subrack 120VDC			✓	✓	✓					
Subrack 28VDC		✓	✓	✓		✓		✓	✓	✓
Subrack 12VDC			✓	✓						
Subrack -12VDC						✓				
Subrack 5VDC						✓				
Rack Power Switch	✓						✓			
MTL Water	✓						✓	✓		
1553B/LRDL	✓						✓			
Subrack RS-232			✓	✓	✓			✓	✓	
Subrack RS-422									✓	✓
File Transfers	✓		✓	✓	✓	✓	✓			
Anicilliary Data	✓		✓	✓	✓	✓				
Broadcast Time	✓		✓	✓	✓	✓			✓	
Medium Rate Data Link (MRDL)	✓	✓	✓	✓	✓	✓	✓			
High Rate Data Link (HRDL)							✓			
Optical Video	✓		✓	✓		✓	✓	✓	✓	
Analog Video							✓			
Emergency Caution and Warning	✓		✓	✓	✓		✓		✓	✓
Smoke Detector	✓						✓			
AAA Fan	✓						✓			

Utilization Fluids

- Internal Thermal Control System (ITCS) fluid sampling performed for all payloads to satisfy ACOMC/OMRSD requirements
- Microgravity Science Glovebox (MSG)
  - Moderate Temperature Loop (MTL) for cooling
    - Servicing of ITCS performed by PD off-line
  - Vacuum (both exhaust and resource)
  - Gaseous Nitrogen (GN2)
- EXPRESS Rack (ER) 3
  - MTL–Servicing of ITCS performed by PD off-site
  - Vacuum exhaust (a.k.a. waste gas)
  - GN2
- ADVASC
  - MTL – Servicing of ITCS performed by KSC

Utilization Stowage

- For UF-2 there will be approximately 26 bags of Utilization stowage in the MPLM.
- The stowage will be located in EXPRESS Rack 3, MSG Rack, and, along with non-Utilization stowage, in Re-supply Stowage Racks (RSRs) and Re-supply Stowage Platforms (RSPs).
- Typical bag is about the size of a mid-deck locker.
- Cables, sample bags, and computers are typical stowage items. These are the approximate number of bags for each experiment/project:
- EXPRESS - 4
- ADVASC - 2
- PCS - 1
- MSG Rack - 13
- HRF Rack - 6

Payload Test and Checkout System (PTCS)

–**PTCS PROVIDES:**

»**Final functional checkout of payload to space station interfaces for U.S. Payloads (ISPR, EXPRESS, or Attached) operating in the U.S. Lab, International Partner (IP) Labs, the Truss, or IP Exposed Facilities**

»**Single payload - multi rack active checkout**

»**Patchable to multi rack locations**

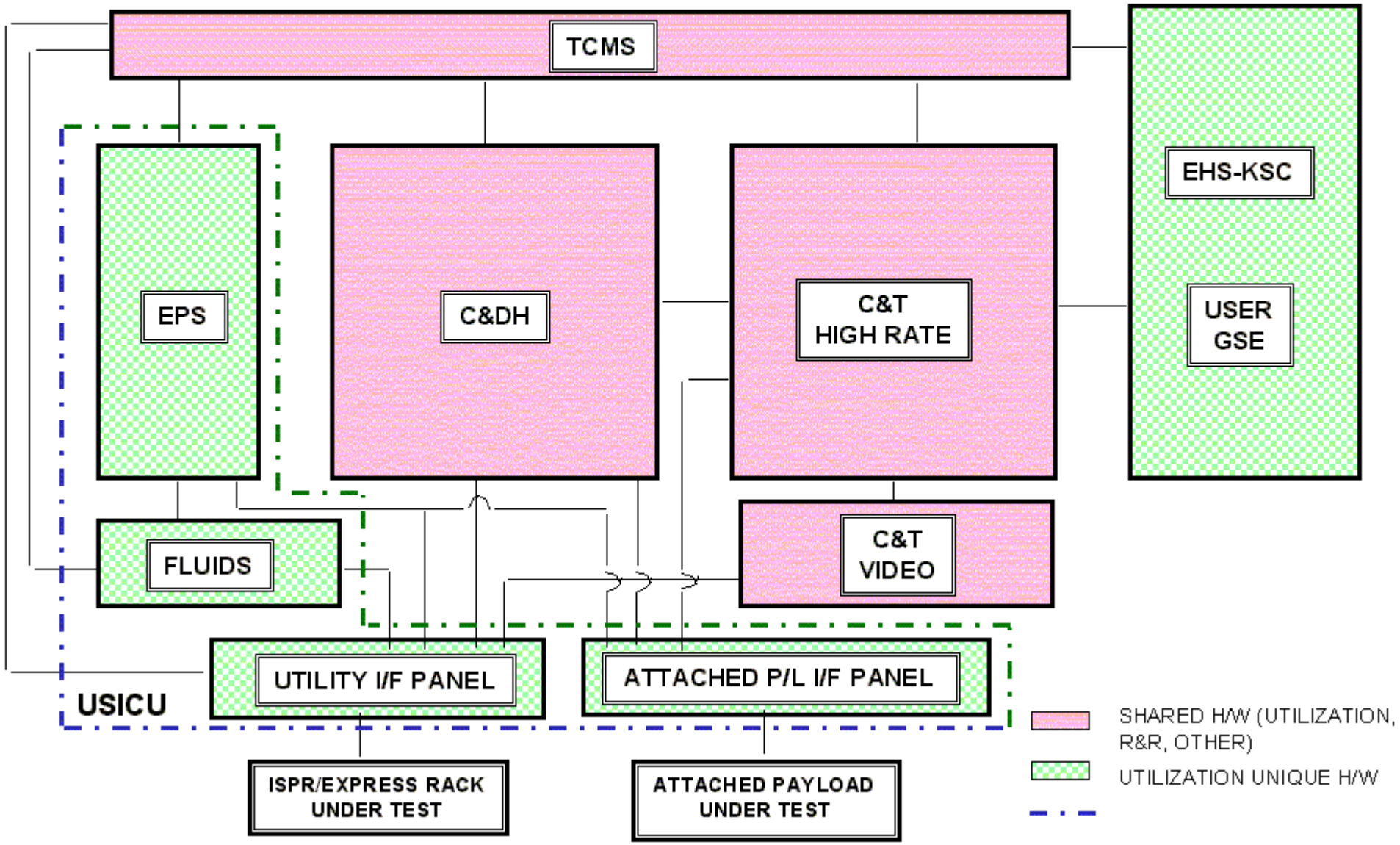
»**Subsystem interface testing**

- **Fluids/Structures**
- **Power**
- **Communication and Tracking (C&T)**
- **Command and Data Handling (C&DH)**

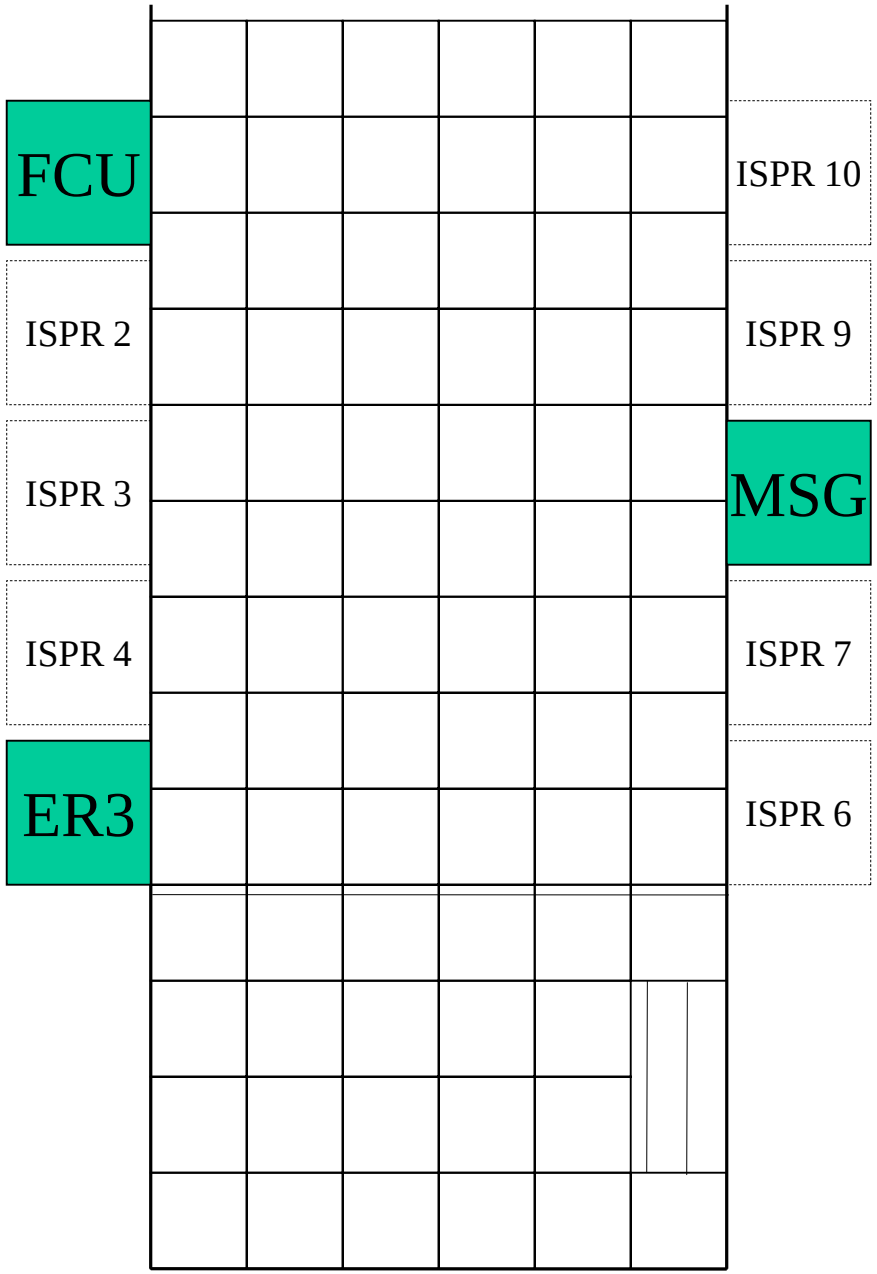
»**Services provided:**

- **Payload Data Services System (PDSS-KSC)**
- **Enhanced HOSC (Huntsville Operations Support Center) System (EHS-KSC)**
- **Test Control & Monitoring System (TCMS)**

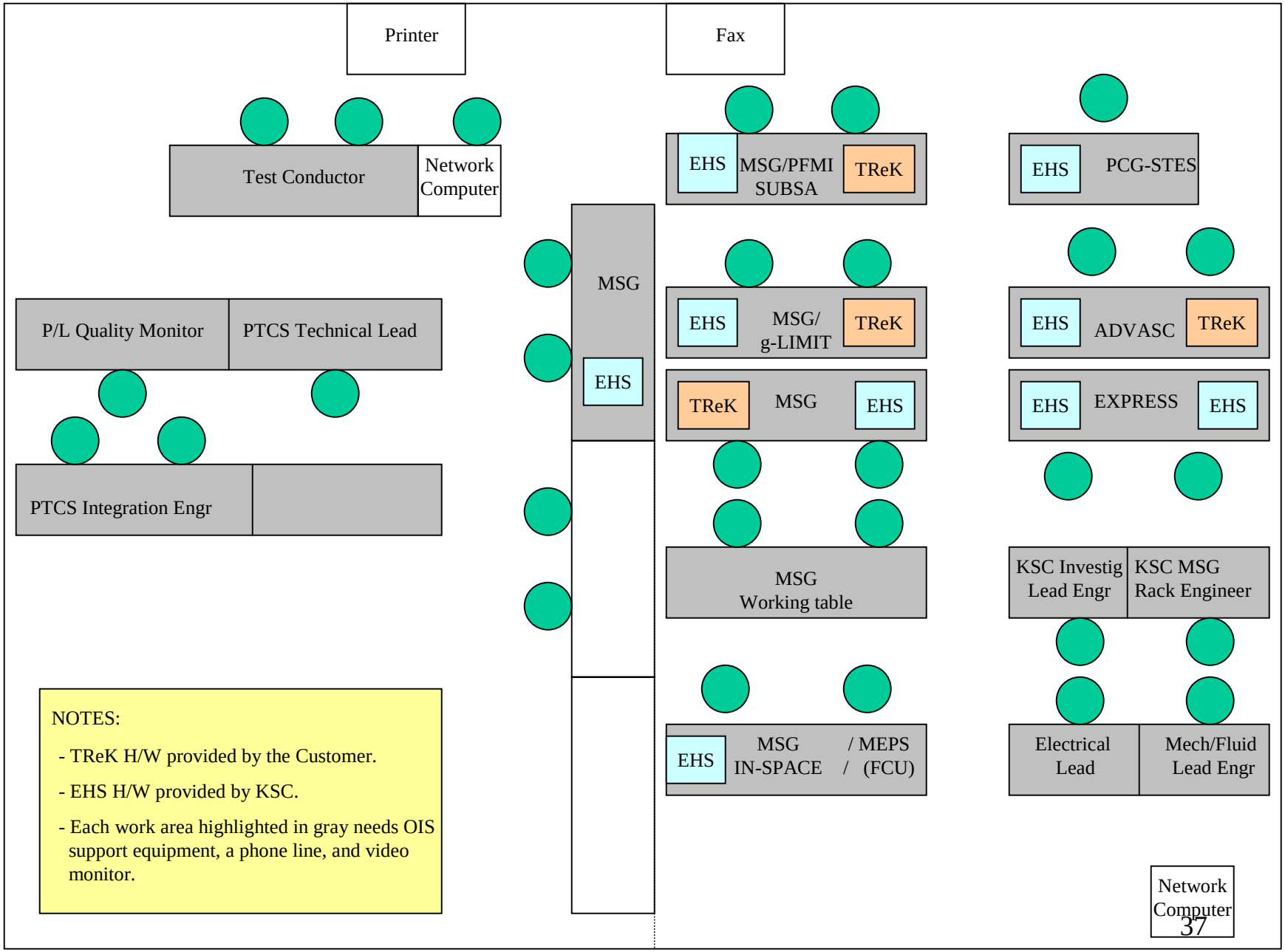
System Configuration



PTCS USICU Floor Configuration



UF-2 USER ROOM LAYOUT

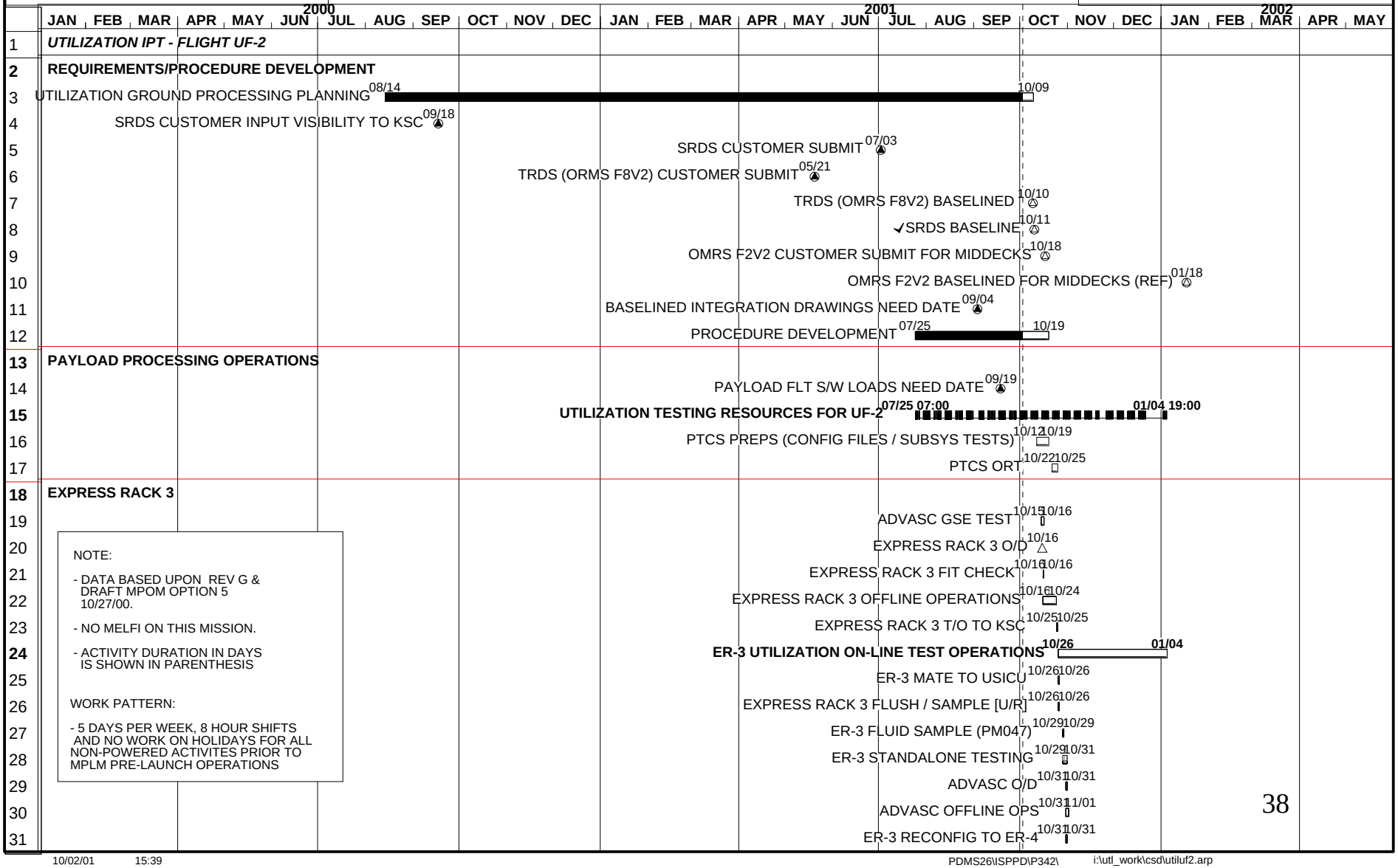


UF-2 Current Schedule

The
NASA / BOEING Co.
KENNEDY SPACE CENTER

INTERNATIONAL SPACE STATION
UF-2 PAYLOAD PROCESSING SCHEDULE
ER3 / MSG

UTILIZATION IPT
DATE: 02 OCT 2001
PAGE: 1 OF 4



NOTE:

- DATA BASED UPON REV G & DRAFT MPOM OPTION 5 10/27/00.
- NO MELFI ON THIS MISSION.
- ACTIVITY DURATION IN DAYS IS SHOWN IN PARENTHESIS

WORK PATTERN:

- 5 DAYS PER WEEK, 8 HOUR SHIFTS AND NO WORK ON HOLIDAYS FOR ALL NON-POWERED ACTIVITES PRIOR TO MPLM PRE-LAUNCH OPERATIONS

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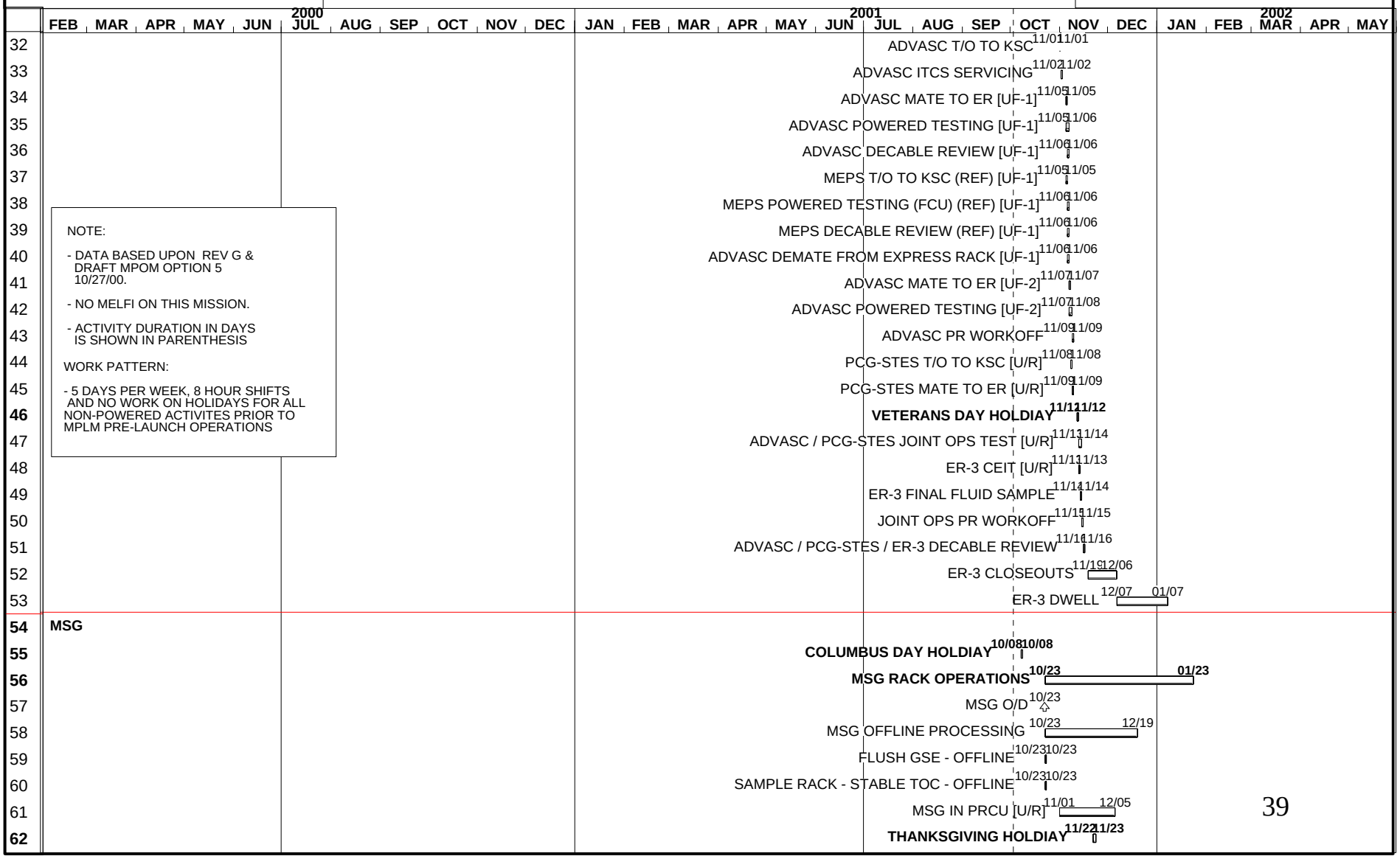
Schedule (cont)

The
NASA / BOEING Co.
KENNEDY SPACE CENTER

INTERNATIONAL SPACE STATION
UF-2 PAYLOAD PROCESSING SCHEDULE
ER3 / MSG

UTILIZATION IPT

DATE: 02 OCT 2001
PAGE: 2 OF 4



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Schedule (cont)

The
NASA / BOEING Co.
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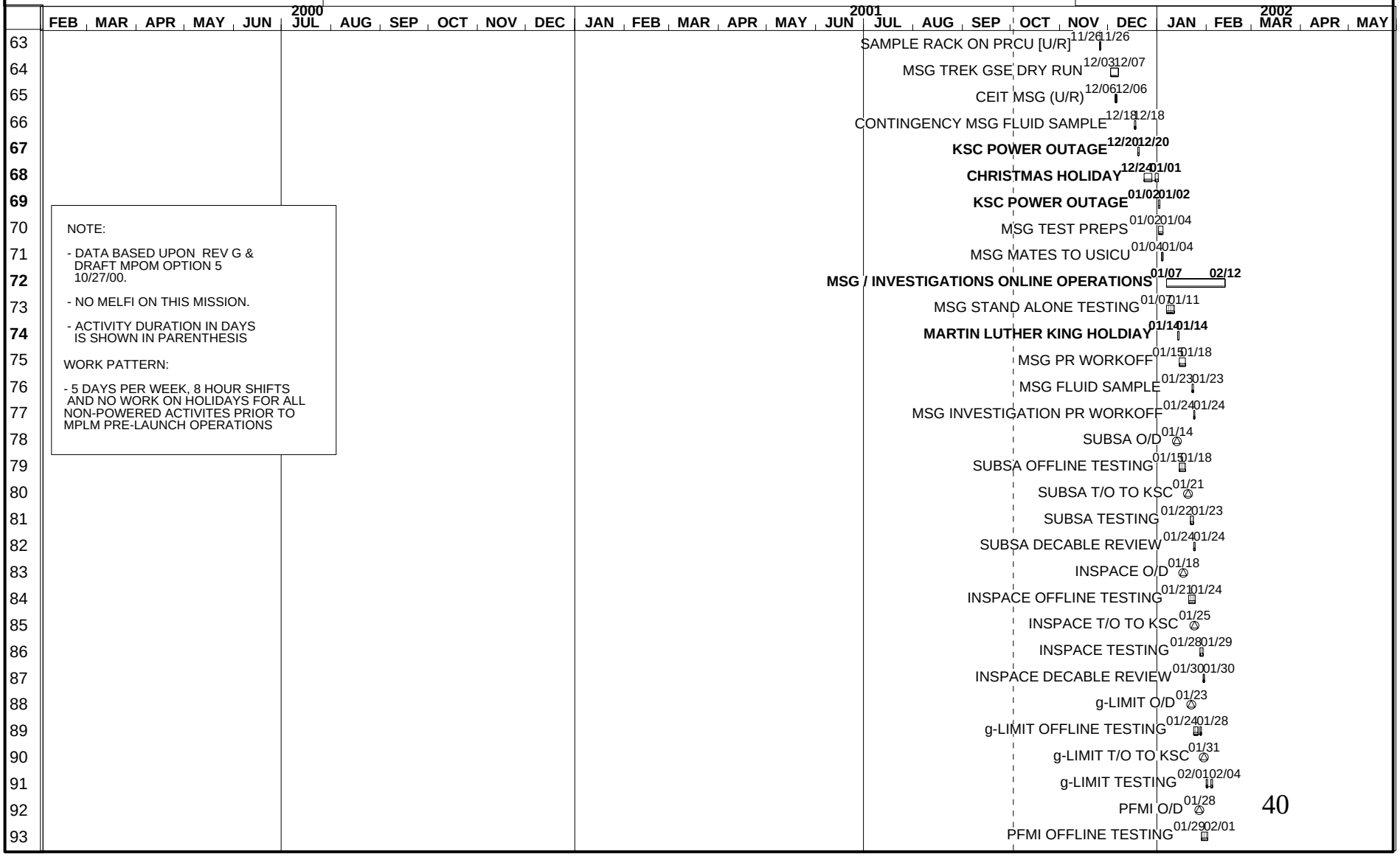
INTERNATIONAL SPACE STATION
UF-2 PAYLOAD PROCESSING SCHEDULE
ER3 / MSG

UTILIZATION IPT

DATE: 02 OCT 2001
PAGE: 3 OF 4



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WORK PATTERN:

- 5 DAYS PER WEEK, 8 HOUR SHIFTS AND NO WORK ON HOLIDAYS FOR ALL NON-POWERED ACTIVITES PRIOR TO MPLM PRE-LAUNCH OPERATIONS

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Schedule (cont)

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KENNEDY SPACE CENTER

INTERNATIONAL SPACE STATION
UF-2 PAYLOAD PROCESSING SCHEDULE
ER3 / MSG

UTILIZATION IPT
DATE: 02 OCT 2001
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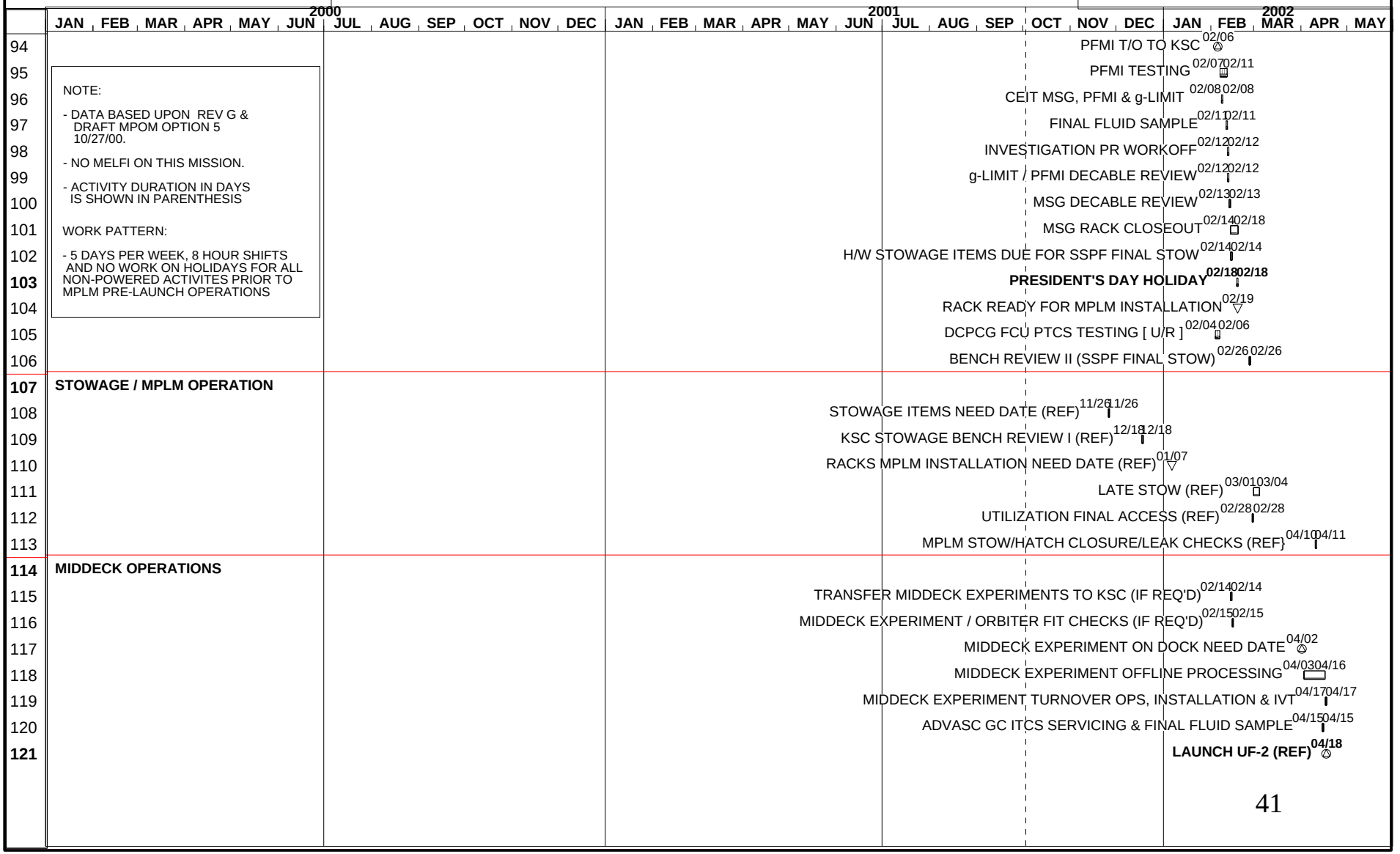

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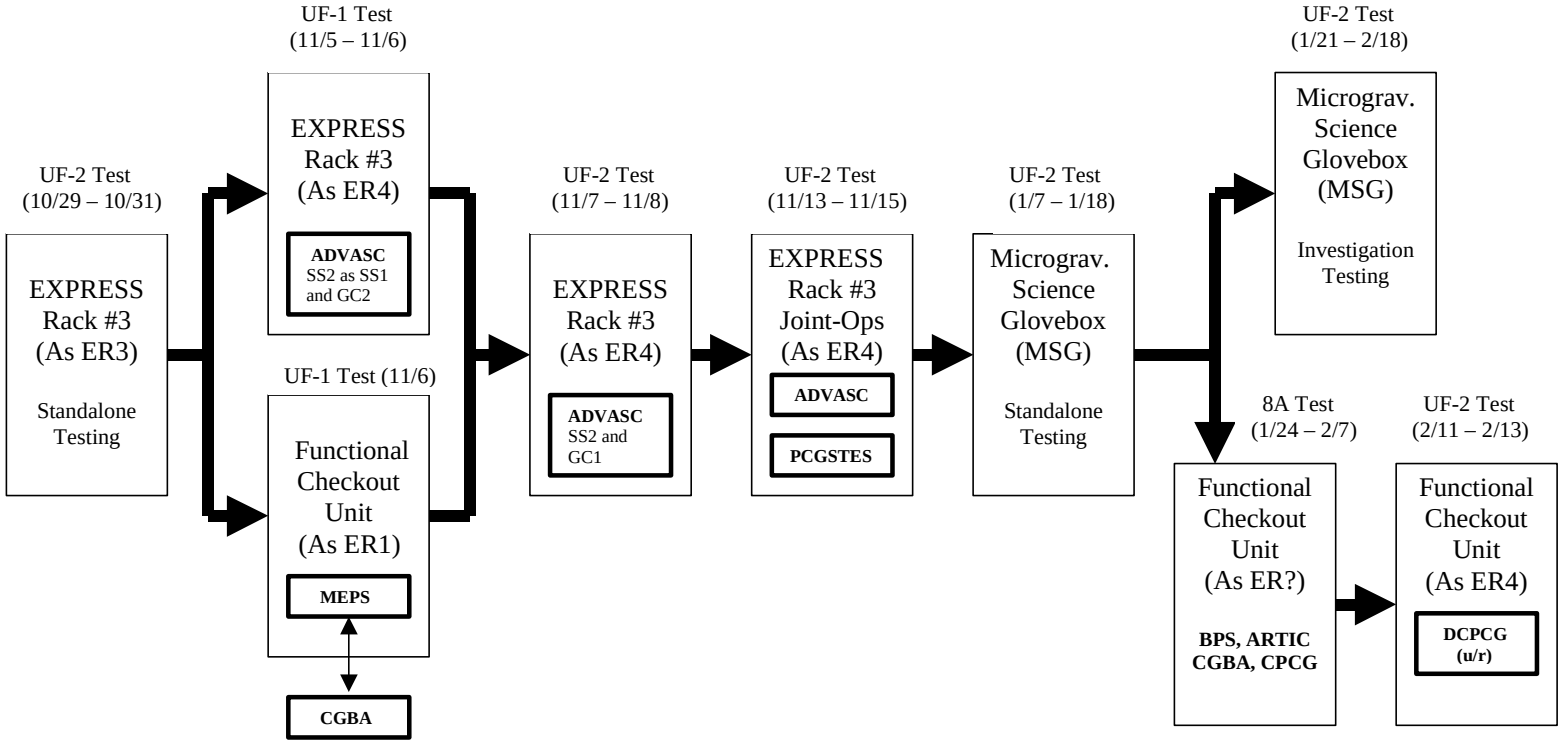
UF-1 / UF-2 / 8A
PTCS Test Flow (10/3/01)



Note: This is an unofficial product. For accurate test dates, refer to Utilization test schedules.

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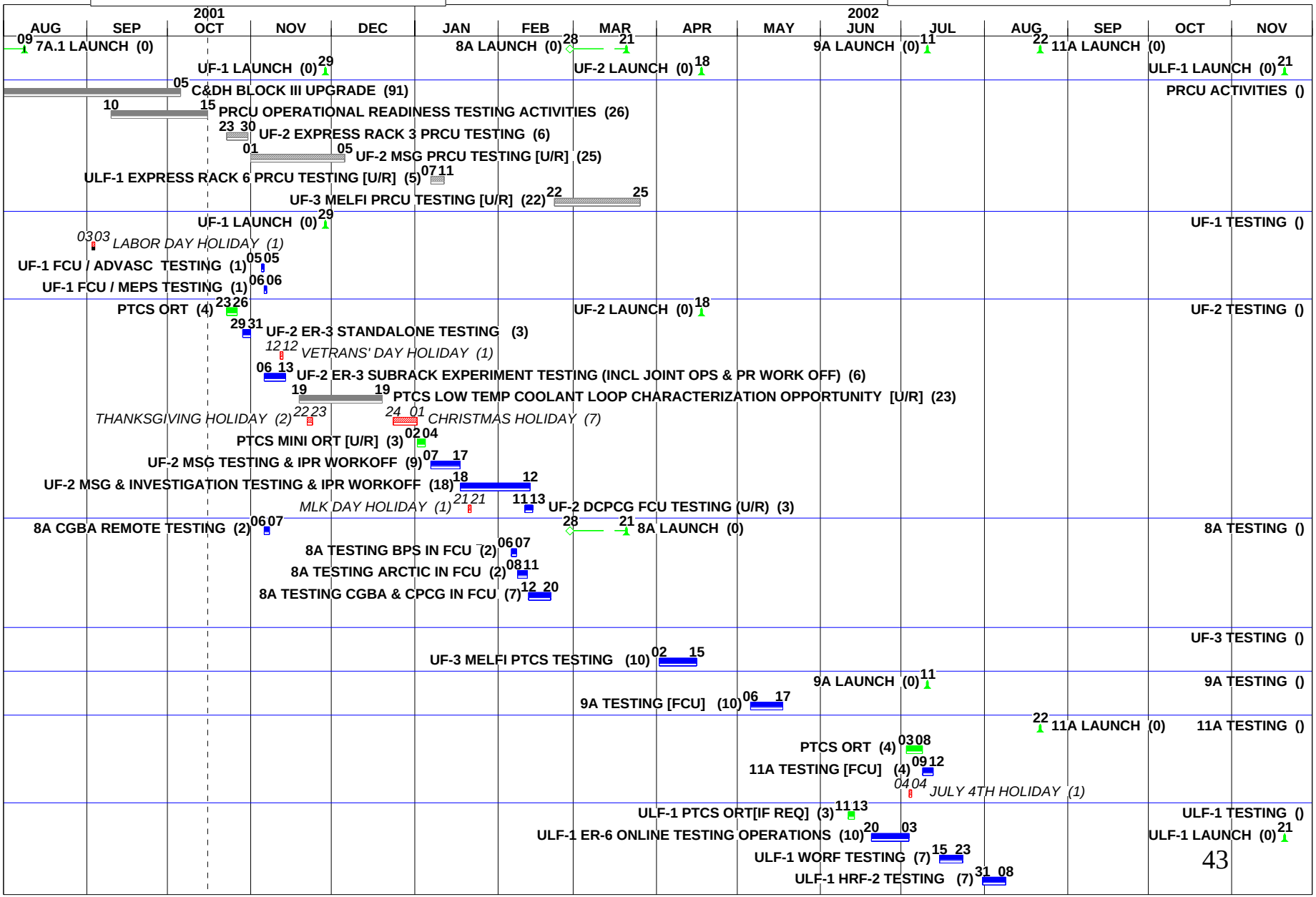
(321)867-5890

10/16/01

BARS INDICATE PERIODS OF EXPERIMENT TESTING AND TROUBLESHOOTING ONLY.
TEST DAYS ARE 12 HOURS IN LENGTH, 5 DAYS A WEEK, NO HOLIDAYS.
SUBJECT TO CHANGE.

UTILIZATION TESTING SCHEDULE
POWER ON TESTING 2001 - 2002

ASSUME SLIPS IN LAUNCH DATES AS INDICATED IN REV G MANIFEST.



Lessons Learned In Place

- A number of processes have been streamlined via the KSC Stowage Working Group. Those directly affecting Utilization include:
  - Bench Review Process Streamlined
    - Bench reviews optimally scheduled during the mission flow to ensure hardware arrives as late as possible
    - A standard procedure generated to capture new process which decreases delays and personnel coverage during a Bench Review
  - Decreased Delays in Receiving Customer Deliveries
    - Stowage Delivery POC's established to minimize the amount of time hardware spends in receiving
    - Utilization Familiarization given to stowage community to facilitate quicker routing of utilization hardware deliveries and just in time on dock need dates.
    - Boeing Stowage Integration personnel being utilized to work daily stowage issues with hardware providers
  - JSC Stowage Hardware Audit for each mission better attended by KSC around L – 7 months to facilitate better planning

Lessons Learned In Place

- Updated the KSC Standard Practices and Procedures (SPP) for Integration Data Packages (IDPs) and SSP 52000-PDS to better document the process, clarify the terminology, and include important software configuration that was previously omitted.
  - PTCS testing has revealed common problem areas across test flows in which the Payload Configuration/documentation did not match the EXPRESS documentation/RIC configuration tables
- Updated the FEC process and related signature requirements to get FEC's through system quicker and reduce paper load.
- Incorporated OZ PE&I into OMRS development and baseline waiver processes
- SRDS PDL screens were updated to incorporate lessons learned from actual use. Payload Data Set Blank Book updates in work.
- Due to security concerns, Customers traveling to KSC are being required to place identification nametags on all their items (briefcases, bags, etc .) and are being requested not to leave them unattended.

Lessons Learned In work

- To decrease delays in shipping and receiving, Information on 1149/shippers needs to be more accurate. KSC is working on an improved shipping guideline. However, the folks who generate the shippers need to receive this information.
- KSC Logistics, stowage team and MSFC are working to clarify and implement the process of properly labeling, packaging and routing software (CDs) that are shipped to KSC for stowage.
- Proper level of Software QA coverage required to witness software loads at KSC needs to be determined to ensure personnel ready to support in timely manner
- Major review performed of the IPR/PR signature requirements. This is being worked as part of PPMR action 2-4.

KSC Utilization Primary Contacts

Position	Contact	Phone	Roles and Responsibilities
Customer Int. Mgr	JoAnn Archer	7-5825	Main KSC Point of contact and customer advocate for Payload Developers throughout entire KSC Processing flow. Establish KSC on dock date. KSC Leader during KSC Offline Processing. Manage Support Requirements. Ensures customer completes/satisfies appropriate Customer Deliverable Documents
Technical Int. Mgr	Roland Schlierf	7-5827	Lead Technical Requirements Management, Turnovers, and Engineering Integration across development, implementation and CoFR
Ops and Test Mgr	Mary Hall	7-5829	Manages Utilization Schedule including PTCS processing, Stowage/MPLM Util. Operations, and Middeck Operations . Test Conductor for Online Operations. Layout for User Room
Electrical Lead	Rob Kuczajda	7-5890	Leads all Payload Test Engineers in procedure development and test implementation. Assists Utilization in all electrical related items.
Mechanical Lead	Luke Setzer	7-5849	Leads all Mechanical Engineers in procedure development and implementation. Assists Utilization in all mechanical related items.
Fluids Lead	Morgan Simpson	7-5857	Lead all water sampling to be satisfy ACOMC spec. and all payload fluid servicing
Software Lead	Sue Sitko	7-5934	Works with team to identify flight software requirements & ensures delivery of flight software to KSC. Works w/ test team to ensure software configuration management practices are followed.
ER3 PTE	Tamara Willingham	7-5858	
ER3 Mech Eng	Kenny Mathews	7-5851	
MSG PTE	Kevin Zari	7-5850	
MSG Mech Eng	Mike Haddock	7-5853	
Cargo/Stowage	Randy Gordon	7-5852	Supervises the packing of stowage bags per Space Station Configuration Control Drawings, and serves as Bench Review task leader during crew inspection of bags.
PTCS Lead	Rob Yaskovic	7-5295	
Quality Engineer	Roger Setterberg	7-0785	

Key Utilization Web Sites

Discipline	Web Sites\Links
Support Requirements	TBD
KSC Schedules	http://www-ss.ksc.nasa.gov/UTILIZATION/Schedules.htm
Technical Requirements\OMRS	http://heron.ksc.nasa.gov/omrs/sts111_PCGSTES.htm
	http://www.usa1.unitedspacealliance.com/usahou/orgs/7022/cargoint/TGHR/index.htm
KSC Procedures	http://spoo.ksc.nasa.gov:8080/missions/issutil/TAPS/STS111/
Utilization	http://www-ss.ksc.nasa.gov/UTILIZATION/DEFAULT.HTM
Payloads Office	http://iss-www.jsc.nasa.gov/ss/issapt/payofc/payoff.html
MSG	http://spoo.ksc.nasa.gov:8080/missions/issutil/msg/index.html
EXPRESS	NA
ADVASC	http://wcsar.engr.wisc.edu/advasc.html
PCG-STES	http://microgravity.msfc.nasa.gov/pcg.html
	http://pcg.tecmasters.com/pcg_main.html
DC-PCG	http://www.cbse.uab.edu
Stowage	Packing Plan (unofficial list of stowage hardware per mission):
	http://iss-www.jsc.nasa.gov/ss/issapt/mio/cargo/MPLMmain.htm
	MPLM Image Maps (unofficial summary/schematic of "what is where")
	http://jsc-ard-0hab.jsc.nasa.gov/sf_intra/csig/station/scsig.htm
	Official Drawings:
	http://edcc.jsc.nasa.gov/edccsearch/
MSFC Microgravity Research Program Office	http://microgravity.nasa.gov

Back Charts
(PTCS Subsystems)

- FLUIDS/STRUCTURES (USICU)
  - System Capabilities:

    Includes GN_2, Vacuum Exhaust, Vacuum Resource, Thermal, Raised Access Floor, and Support Structure
- POWER SUBSYSTEM (EPS-USICU)
  - System Capabilities:

    Provides Interface B and Interface C power from Power Distribution Assembly (PDA)

    Allows local control via panel and remote control via TCMS
- COMMUNICATION AND TRACKING (C&T)
  - System Capabilities:

    System provides high fidelity compliment of on-orbit interfaces through the use of Program FEUs

    (HRFM, VBSP)

    Provides services to verify video and telemetry pathways/interfaces
- COMMAND & DATA HANDLING (C&DH)
  - System Capabilities:

    System provides high fidelity compliment of on-orbit interfaces through the use of Program FEUs (PL MDM, PEHGs)

    Provides services to verify command and data pathways/interfaces

Back Charts
(PTCS Subsystems)

- PDSS/EHS-KSC (Payload Data Services System/ Enhanced HOSC System - KSC)
  - System Capabilities:

    PDSS-KSC provides payload telemetry routing and distribution to EHS-KSC and User GSE.

    EHS-KSC provides a user interface for uplinking data to ISPR/AP and accepting health and status data from the ISPR/AP

    PDSS-KSC is a subset of the MSFC PDSS system (H/W and S/W)

    EHS-KSC is a subset of the MSFC EHS system (H/W and S/W)

- TEST CONTROL MONITOR SYSTEM (TCMS)
  - System Capabilities:

    Utilization: Payload to station interface tests

    Resupply/Return; MPLM post delivery verfication, prelaunch checkout, and launch operations